

VI. CLAIMS

I claim:

- 5 1. A method of purifying juice obtained from plant material, comprising the steps of:

 - a. obtaining plant material;
 - b. removing juice from said plant material to obtain a process liquid, wherein
said process liquid contains sucrose, non-sucrose substances, and water,
and wherein a portion of said non-sucrose substances comprise dissolved
material;
 - c. introducing a mixture of gases into said process liquid;
 - d. establishing a process liquid-gas interface area between said process liquid
and said mixture of gases; and
 - e. reducing concentration of said dissolved material within said process
liquid to less than the initial concentration of said dissolved material in
said process liquid.

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2 A method of purifying juice obtained from plant material as described in claim 1,
wherein said step of removing juice from said plant material comprises diffusing said
plant material to obtain said process liquid.

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3. A method of purifying juice obtained from plant material as described in claim 1,
wherein said step of removing juice from said plant material comprises milling said plant
material to obtain said process liquid.

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4. A method of purifying juice obtained from plant material as described in claim 1,
wherein said plant material is selected from the group consisting of sugarcane, sugar
beets, and sweet sorghum.

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5. A method of purifying juice obtained from plant material as described in claim 1,
wherein said non-sucrose substances comprise at least one substance selected from the
group consisting of insoluble plant material, soluble plant material, soil particles,
fertilizer, saccharides other than sucrose, organic non-sugars, inorganic non-sugars,

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dissolved gases, organic acids, inorganic acids, proteins, phosphates, carbonate ions, bicarbonate ions, metal ions, pectins, coloring agents, saponins, wax, fats, and gums.

6. A method of purifying juice obtained from plant material as described in claim 1,
5 wherein at least a portion of said dissolved material in said juice comprises volatile
material.

7. A method of purifying juice obtained from plant material as described in claim 1,
wherein said dissolved material in said juice comprises dissolved gases.

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8. A method of purifying juice obtained from plant material as described in claim 7,
wherein said dissolved gases in said juice are selected from the group consisting of
carbon dioxide and sulfur dioxide.

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9. A method of purifying juice obtained from plant material as described in claim 7,
wherein dissolved gases in said juice comprise carbon dioxide in a form selected from the
group consisting of carbon dioxide gas, carbonate ion, bicarbonate ion, and carbonic acid.

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10. A method of purifying juice obtained from plant material as described in claim 7,
wherein dissolved gases in said juice comprise sulfur dioxide in a form selected from the
group consisting of sulfur dioxide gas, sulfuric acid, and sulfurous acid.

11. A method of purifying juice obtained from plant material as described in claim 1,
wherein dissolved material comprises aqueous acids.

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12. A method of purifying juice obtained from plant material as described in claim 11,
wherein said aqueous acids are selected from the group consisting of phosphoric acid,
hydrochloric acid, sulfuric acid, citric acid, oxalic acid, succinic acid, fumaric acid, lactic
acid, glycolic acid, pyrrolidone-carboxylic acid, formic acid, acetic acid, butyric acid,
30 maleic acid, and lactic acid.

13. A method of purifying juice obtained from plant material as described in claim 1,
wherein said mixture of gases is selected from the group consisting of atmospheric gases,
filtered atmospheric gases, air, and filtered air.

14. A method of purifying juice obtained from plant material as described in claim 1, wherein said step of increasing interface surface area between said juice and said mixture of gases comprises agitating said juice.

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15. A method of purifying juice obtained from plant material as described in claim 1, wherein said step of increasing interface surface area between said juice and said mixture of gases comprises spraying said juice.

10 16. A method of purifying juice obtained from plant material as described in claim 1, wherein said step of increasing interface surface area between said juice and said mixture of gases comprises sparging said juice with said mixture of gases.

15 17. A method of purifying juice obtained from plant material as described in claim 1, wherein said step of increasing interface surface area between said juice and said mixture of gases comprises injecting said mixture of gases into said juice.

18. A method of purifying juice obtained from plant material as described in claim 1, wherein said step of increasing interface surface area between said juice and said mixture 20 of gases comprises gas stripping said juice with said mixture of gases.

19. A method of purifying juice obtained from plant material as described in claim 1, wherein said steps of:

- c. exposing said juice to a mixture of gases;
 - 25 d. transferring a portion of said dissolved material from said juice to said mixture of gases prior to addition of base;
 - e. increasing interface surface area between said juice and said mixture of gases;
 - f. increasing transfer rate of said dissolved material from said juice to said 30 mixture of gases; and
 - g. reducing dissolved material within said juice
- comprises injecting said mixture of gases into a stream of juice to form a mixed stream of said juice and said mixture of gases, whereby at least some of said

dissolved material transfers from said stream of juice into said mixture of injected gases.

20. A method of purifying juice obtained from plant material as described in claim 19,
5 wherein said stream of juice comprises a continuous stream of juice.

21. A method of purifying juice obtained from plant material as described in claim 20,
wherein said mixed stream comprises a continuous mixed stream.

10 22. A method of purifying juice obtained from plant material as described in claim 21,
further comprising the step of generating a reduced pressure on said mixed stream.

15 23. A method of purifying juice obtained from plant material as described in claim 22,
further comprising the step of configuring said stream of juice to generate said reduced
pressure on said mixed stream.

24. A method of purifying juice obtained from plant material as described in claim 19,
further comprising the step of separating said dissolved material transferred to said
mixture of gases from said mixed stream.

20 25. A method of purifying juice obtained from plant material as described in claim 24,
further comprising the step of generating a gas flow of said mixture of gases separated
from said mixed supply stream in response to a source of reduced pressure.

25 26. A method of purifying juice obtained from plant material as described in claim 19,
23, or 25, further comprising the step of reducing the pressure on said interface surface
area between said juice and said mixture of gases to less than atmospheric pressure.

27. A method of purifying juice obtained from plant material as described in claim 1,
30 wherein said step of reducing said dissolved material within said juice comprises reducing
concentration of hydronium ion in said juice.

28. A method of purifying juice obtained from plant material as described in claim 1, wherein said step of reducing said dissolved material within said juice comprises reducing capacity of said juice to generate hydronium ion.
- 5 29. A method of purifying juice obtained from plant material as described in claim 1, wherein said step of reducing said dissolved material within said juice further comprises raising the pH value of said juice an amount selected from the group consisting of 0.1 pH, 0.2 pH, 0.3 pH, 0.4 pH, 0.5 pH, 0.6 pH, 0.7 pH, 0.8 pH, 0.9 pH, 1.0 pH, 1.1 pH, 1.2, pH1.3, pH1.4, pH1.5, pH1.6, pH1.7, pH1.8, pH1.9, 2.0 pH.
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30. A method of purifying juice obtained from plant material as described in claim 29, further comprising the step of reducing the amount base added to a volume of said juice having reduced dissolved material to establish an initial pH value of between about 11.0 and about 12.0.
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31. A method of purifying juice obtained from plant material as described in claim 29, further comprising the step of reducing the amount base added to a volume of said juice having reduced dissolved material to establish an initial pH value of between about 11.5 and about 12.5.
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32. A method of purifying juice obtained from plant material as described in claim 29, further comprising the step of reducing the amount base added to a volume of said juice having reduced dissolved material to establish a pH value corresponding to an iso-electric point of at least a portion of said non-sucrose substances in said juice.
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33. A method of purifying juice obtained from plant material as described in claim 1, wherein said step of reducing said dissolved material within said juice comprises reducing aqueous acids formed by dissolved gases in said juice.
- 30 34. A method of purifying juice obtained from plant material as described in claim 1, further comprises the step of removing at least a portion of insoluble materials from said juice prior to said step of exposing said juice to a mixture of gases.

35. A method of purifying juice obtained from plant material as described in claim 1, further comprises the step of removing at least a portion of insoluble materials from said juice after said step of exposing said juice to a mixture of gases.

5 36. A method of purifying juice obtained from plant material as described in claim 1, further comprises the step of adding a first amount of base to said juice after said step of reducing said dissolved material within said juice.

10 37. A method of purifying juice obtained from plant material as described in claim 36, wherein said step of adding a first amount of base to said juice after said step of reducing said dissolved material within said juice comprises the step of pre-liming said juice.

15 38. A method of purifying juice obtained from plant material as described in claim 36, wherein said step of adding a first amount of base to said juice after said step of reducing said dissolved material within said juice comprises the step of cold main liming said juice.

20 39. A method of purifying juice obtained from plant material as described in claim 36, wherein said step of adding a first amount of base to said juice after said step of reducing said dissolved material within said juice comprises hot main liming said juice.

25 40. A method of purifying juice obtained from plant material as described in claim 36, wherein said step of adding a first amount of base to said juice after said step of reducing said dissolved material within said juice comprises adding a reduced amount of base to said juice based upon reduction of said dissolved material within said juice.

30 41. A method of purifying juice obtained from plant material as described in claim 36, further comprising the step of adding a second amount of base to said juice after said step of reducing said dissolved material within said juice comprises the step of cold main liming said juice.

42. A method of purifying juice obtained from plant material as described in claim 41, wherein said step of adding a second amount of base to said juice after said step of

reducing said dissolved material within said juice comprises the step of hot main liming said juice.

43. A method of purifying juice obtained from plant material as described in claim 41,
5 wherein said step of adding a first amount of base to said juice after said step of reducing said dissolved material within said juice comprises adding a reduced amount of base to said juice based upon reduction of said dissolved material within said juice.
44. A method of purifying juice obtained from plant material as described in claim 41,
10 further comprising the step of adding a third amount of base to said juice after said step of reducing said dissolved material within said juice comprises the step of hot main liming said juice.
45. A method of purifying juice obtained from plant material as described in claim 44,
15 wherein said step of adding a third amount of base to said juice after said step of reducing said dissolved materials within said juice comprises the step of intermediate liming said juice.
46. A method of purifying juice obtained from plant material as described in claim 44,
20 further comprising adding a fourth amount of base to said juice after said step of reducing said dissolved material within said juice.
47. A method of purifying juice obtained from plant material as described in claim 36,
25 41, 44, or 46, wherein said base is selected from the group consisting of calcium oxide, calcium hydroxide and milk of lime.
48. A method of purifying juice obtained from plant material as described in claim 36
or 41, further comprising the step of carbonating said juice with a first amount of gas.
- 30 49. A method of purifying juice obtained from plant material as described in claim 48,
wherein said first amount gas is selected from the group consisting of atmospheric gases, air, and carbon dioxide.

50. A method of purifying juice obtained from plant material as described in claim 48, further comprising the step of forming precipitates from said base and said first amount of gas.

5 51. A method of purifying juice obtained from plant material as described in claim 41 or 44, further comprising the step of carbonating said juice with a second amount of gas.

10 52. A method of purifying juice obtained from plant material as described in claim 51, wherein said gas is selected from the group consisting of atmospheric gases, air, and carbon dioxide.

15 53. A method of purifying juice obtained from plant material as described in claim 51, further comprising the step of forming precipitates from said base and said second amount of gas.

54. A method of purifying juice obtained from plant material as described in claim 44 or 46, further comprising the step of carbonating said juice with a third amount of gas.

20 55. A method of purifying juice obtained from plant material as described in claim 54, wherein said gas is selected from the group consisting of atmospheric gases, air, and carbon dioxide.

25 56. A method of purifying juice obtained from plant material as described in claim 54, further comprising the step of forming precipitates from said base and said third amount of gas.

30 57. A method of purifying juice obtained from plant material as described in claim 50, further comprises the step of trapping at least a portion of said non-sucrose substances in said juice with said precipitates.

58. A method of purifying juice obtained from plant material as described in claim 53, further comprises the step of trapping at least a portion of said non-sucrose substances in said juice with said precipitates.

59. A method of purifying juice obtained from plant material as described in claim 56, further comprises the step of trapping at least a portion of said non-sucrose substances in said juice with said precipitates.

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60. A method of purifying juice obtained from plant material as described in claim 57, further comprises the step of separating said precipitates trapping said non-sucrose substances from said juice.

10 61. A method of purifying juice obtained from plant material as described in claim 58, further comprises the step of separating said precipitates trapping said non-sucrose substances from said juice.

15 62. A method of purifying juice obtained from plant material as described in claim 59, further comprises the step of separating said precipitates trapping said non-sucrose substances from said juice.

63. A method of purifying juice obtained from plant material as described in claim 60, further comprises the step of reducing the amount of water in said juice.

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64. A method of purifying juice obtained from plant material as described in claim 61, further comprises the step of reducing the amount of water in said juice.

25 65. A method of purifying juice obtained from plant material as described in claim 62, further comprises the step of reducing the amount of water in said juice.

66. A method of purifying juice obtained from plant material as described in claim 63, further comprises the step of crystallizing sucrose in said juice.

30 67. A method of purifying juice obtained from plant material as described in claim 64, further comprises the step of crystallizing sucrose in said juice.

68. A method of purifying juice obtained from plant material as described in claim 65, further comprises the step of crystallizing sucrose in said juice.

69. Sugar produced in accordance with the process of claim 66.

70. Sugar produced in accordance with the process of claim 67.

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71. Sugar produced in accordance with the process of claim 68.

72. Juice having reduced dissolved material in accordance with the process of claim 1,
2, 3, 4, 6, 7, 11, 17, 19, 27, or 29.

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73. Juice having reduced aqueous acid in accordance with the process of claim 5, 11,
12, or 33.

74. Juice having reduced volatile material in accordance with the process of claim 6.

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75. Juice having reduced dissolved gases in accordance with the process of 7, 8, or 9.

76. A method of purifying juice obtained from plant material, comprising:

a. obtaining juice from plant material, where in said juice contains sucrose,
non-sucrose substances, and water;

b. reducing dissolved gases in said juice;

c. preliming said juice;

d. cold main liming said juice;

e. hot main liming

f. adding a first amount of carbon dioxide to said juice;

g. precipitating a first amount of calcium carbonate;

h. trapping a first portion of said non-sucrose substances with said calcium
carbonate

i. removing said first portion of said non-sucrose substances with said
calcium carbonate from said juice;

j. intermediate liming said juice;

k. adding a second amount of carbon dioxide to said juice;

l. precipitating a second amount of calcium carbonate from said juice;

- 5 m. trapping a second portion of said non-sucrose substances in said calcium carbonate
n. removing said second portion of said non-sucrose substances with said calcium carbonate from said juice; and
o. crystallizing said sucrose.

77. A method of purifying juice obtained from plant material as described in claim 76, wherein said step of reducing dissolved gases in said juice comprises the steps of:

- 10 a. generating a stream of said juice;
b. injecting a mixture of gases into said stream of said juice to form a mixed stream comprising said juice and said mixture of gases; and
c. transferring a portion of said dissolved gases from said juice to said mixture of gases.

15 78. A method of purifying juice obtained from plant material as described in claim 77, wherein said stream of juice comprises a continuous stream of juice.

79. A method of purifying juice obtained from plant material as described in claim 77, wherein said mixed stream comprises a continuous mixed stream.

20 80. A method of purifying juice obtained from plant material as described in claim 79, further comprising the step of generating a reduced pressure on said mixed stream.

25 81. A method of purifying juice as described in claim 80, further comprising the step of configuring said stream of juice to generate said reduced pressure on said mixed stream.

30 82. A method of purifying juice as described in claim 77 or 78, further comprising the step of separating said mixture of gases containing said dissolved gases transferred from said juice.

83. A method of purifying juice as described in claim 82, further comprising the step of generating a gas flow of said mixture of gases containing said dissolved gases transferred from said juice in response to a source of reduced pressure.

84. A method of purifying juice as described in claim 76, wherein said step of reducing dissolved gases in said juice comprises the steps of:

- a. generating a stream of said juice having an interface surface area fluidically coupled to said mixture of gases within a containment element;
- b. increasing said interface surface area of said juice fluidically coupled to said mixture of gases;
- c. decreasing the pressure within said containment element; and
- d. transferring at least a portion of said dissolved gases from said juice to said mixture of gases.

85. A method of purifying juice as described in claim 84, wherein said step of increasing said interface surface area of said juice comprises generating droplets of said juice.

86. A method of purifying juice as described in claim 76, wherein said step of reducing dissolved gases in said juice comprises the steps of:

- a. introducing said stream of juice into a first end of a containment element;
- b. spreading said juice over a distribution media within said containment element;
- c. introducing said mixture of gases into a second end of said containment element;
- d. generating a counter current flow between said juice spread over said distribution media and said mixture of gases.

87. A method of purifying juice as described in claim 76, wherein said plant material is selected from the group consisting of sugarcane, sugar beets, and sweet sorghum.

88. A method of purifying juice as described in claim 76, 77, 84, or 86, wherein said dissolved gases in said juice are selected from the group consisting of carbon dioxide and sulfur dioxide.

89. A method of purifying juice as described in claim 76, 77, 84, or 86, wherein said step of reducing dissolved gases in said juice further comprises the step of reducing acids in said juice.

5 90. A method of purifying juice as described in claim 89, wherein said acids are selected from the group consisting of carbonic acid, phosphoric acid, hydrochloric acid, sulfuric acid, citric acid, oxalic acid, succinic acid, fumaric acid, lactic acid, glycolic acid, pyrrolidone-carboxylic acid, formic acid, acetic acid, butyric acid, maleic acid, and lactic acid.

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91. A method of purifying juice obtained from plant material, comprising the steps of:

- a. obtaining plant material;
- b. removing juice from at least a portion of said plant material, wherein said juice contains sucrose, non-sucrose substances, and water; and wherein at least some of said non-sucrose substances comprise dissolved material;
- c. exposing said juice to a mixture of gases;
- d. transferring a portion of said dissolved material from said juice to said mixture of gases;
- e. generating an increased interface surface area between said juice and said mixture of gases;
- f. increasing transfer rate of said dissolved material from said juice to said mixture of gases;
- g. reducing the amount of dissolved material within said juice; and
- h. separating said mixture of gases containing said dissolved material transferred from said juice.

20 92. A method of purifying juice obtained from plant material, comprising the steps of:

- a. obtaining plant material;
- b. removing juice from at least a portion of said plant material, wherein said juice contains sucrose, non-sucrose substances, and water, and wherein at least some of said non-sucrose substances comprise volatile substances;
- c. exposing said juice to a mixture of gases;
- d. transferring a portion of said volatile substances from said juice to said mixture of gases;

- e. generating an increased interface surface area between said juice and said mixture of gases;
- f. increasing transfer rate of said volatile substances from said juice to said mixture of gases;
- 5 g. reducing the amount of volatile material within said juice; and
- h. separating said mixture of gases containing said volatile substances transferred from said juice.

93. A juice purification system, comprising:

- 10 a. juice obtained from plant material, wherein said juice contains sucrose, non-sucrose substances and water, and wherein said non-sucrose substances comprise at least one dissolved material that decreases pH of said juice;
 - b. at least one gas having a partial pressure lower than said at least one dissolved material;
 - 15 c. a gas injector to mix said at least one gas with said juice;
 - d. an interface at which at least a portion of said at least one dissolved material transfers from said juice to said at least one gas;
 - e. atmosphere fluidically coupled to said to said interface,
- 20 whereby transfer of at least a portion of said dissolved material to said at least one gas increases pH of said juice.

94. A juice purification system as described in claim 93 wherein said juice comprises juice obtained from a plant material selected from the group consisting of sugar cane, sugar beet, and sweet sorghum.

95. A juice purification system as described in claim 93 wherein said juice comprises a liquid obtained from plant material with a process selected from the group consisting of diffusion, and mill press.

30 96. A juice purification system as described in claim 93 wherein dissolved material comprises carbon dioxide in a form selected from the group consisting of carbon dioxide gas, carbonate ion, bicarbonate ion, and carbonic acid.

97. A juice purification system as described in claim 93 wherein dissolved material comprises sulfur dioxide in a form selected from the group consisting of sulfur dioxide gas, sulfuric acid, and sulfurous acid.

5 98. A juice purification system as described in claim 93 wherein dissolved material comprises aqueous acids.

99. A juice purification system as described in claim 98 wherein aqueous acids comprise aqueous acids selected from the group consisting of phosphoric acid,
10 hydrochloric acid, sulfuric acid, citric acid, oxalic acid, succinic acid, fumaric acid, lactic acid, glycolic acid, pyrrolidone-carboxylic acid, formic acid, acetic acid, butyric acid, maleic acid, and lactic acid.

100. A juice purification system as described in claim 93 wherein said at least one gas having a partial pressure lower than said at least one dissolved material is selected from the group consisting of atmospheric gas, filtered atmospheric gas, scrubbed atmospheric gas, and purified gas.

101. A juice purification system as described in claim 93 wherein said increase in pH occurs without addition of base.

102. A juice purification system as described in claim 101 wherein said base is selected from the group consisting of calcium oxide, calcium hydroxide, and milk of lime.

25 103. A juice purification system as described in claim 93 wherein said gas injector has a configuration to mix said at least one gas with a stream of said juice.

104. A juice purification system as described in claim 93 wherein said gas injector has a configuration comprising a gas transfer conduit having an aperture to deliver said at
30 least one gas into said stream of said juice.

105. A juice purification system as described in claim 104 wherein said stream of said juice comprises a continuous stream of said juice fluidically responsive to said gas injector.

106. A juice purification system as described in claim 105 wherein said continuous stream of said juice has a variably adjustable flow rate.

107. A juice purification system as described in claim 106 wherein said variably
5 adjustable flow rate is responsive to concentration of said at least one dissolved material that decreases pH of said juice.

108. A juice purification system as described in claim 104 wherein said stream of juice comprises an intermittent stream of said juice.

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109. A juice purification system as described in claim 93 wherein said at least one gas injector has a variably adjustable flow rate of at least one gas having a partial pressure lower than said at least one dissolved material

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110. A juice purification system as described in claim 93 further comprising an increased interface surface area.

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111. A juice purification system as described in claim 93 further comprising a gas distribution element to mix said at least one gas into substantially the entire volume of said juice.

112. A juice purification system as described in claim 111 wherein said gas distribution element comprises an impeller of a pump.

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113. A juice purification system as described in claim 111 wherein said gas distribution element comprises a reduction in the size of conduit in which said stream of juice flows.

114. A juice purification system as described in claim 93 further comprising a source of reduced pressure responsive to said at least one gas and said juice.

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115. A juice purification system as described in claim 93 further comprising a gas separator responsive to said at least one gas, wherein said at least one gas further comprises said portion of at least one dissolved material transferred from said juice.

116. A juice purification system as described in claim 93 further comprising a source of reduced pressure responsive to said at least one gas, wherein said at least one gas further comprises said portion of at least one dissolved material transferred from said juice.

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117. A juice purification system as described in claim 116 wherein said source of reduced pressure comprises atmospheric pressure.

118. A juice purification system as described in claim 117 wherein said source of
10 reduced pressure comprises a vacuum pump.

119. A juice purification system, comprising:

- a. juice containing an amount of carbon dioxide;
- b. at least one gas responsive to an interface with said juice, wherein partial pressures of said at least one gas allow transfer of a portion of said amount of carbon dioxide from said juice to said at least one gas at said interface;
- c. at least one gas injector configured to mix said at least one gas responsive to said interface with said juice;
- d. a gas separator fluidically coupled to said at least one gas, wherein said at least one gas further comprises said portion of said amount of carbon dioxide transferred from said juice.

120 A juice purification system as described in claim 119 wherein said juice comprises juice obtained from a plant material selected from the group consisting of sugar cane,
25 sugar beet, and sweet sorghum.

121. A juice purification system as described in claim 119 wherein said juice comprises liquid obtained from plant material with a process selected from the group consisting of diffusion and mill press.

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122. A juice purification system as described in claim 119 wherein said dissolved material comprises carbon dioxide in a form selected from the group consisting of carbon dioxide gas, carbonate ion, bicarbonate ion, and carbonic acid.

123. A juice purification system as described in claim 119 wherein said at least one gas responsive to an interface with said juice, wherein partial pressures of said at least one gas allow transfer of a portion of said amount of carbon dioxide from said juice to said at least one gas at said interface is selected from the group consisting of atmospheric gas,
5 filtered atmospheric gas, scrubbed atmospheric gas, and purified gas.

124. A juice purification system as described in claim 119 wherein said juice has a pH value, and wherein said pH value of said juice increases in response to transfer of said portion of said amount of carbon dioxide to said at least one gas without addition of base.
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125. A juice purification system as described in claim 119 wherein said base is selected from the group consisting of calcium oxide, calcium hydroxide, and milk of lime.

126. A juice purification system as described in claim 119 wherein said at least one gas injector configured to mix said at least one gas responsive to said interface with said juice comprises a gas transfer conduit having an aperture fluidically coupled to a stream of said juice.
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127. A juice purification system as described in claim 126 wherein said stream of said juice comprises a continuous stream of said juice.
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128. A juice purification system as described in claim 127 wherein said continuous stream of said juice further comprises a variably adjustable flow rate.

25 129. A juice purification system as described in claim 128 wherein said variably adjustable flow rate responds to said amount of carbon dioxide contained in said juice.

130. A juice purification system as described in claim 126 wherein said stream of said juice comprises an intermittent stream of said juice.
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131. A juice purification system as described in claim 130 wherein intermittent flow responds to said amount of carbon dioxide contained in said juice.

132. A juice purification system as described in claim 126 wherein said at least one gas injector has a variably adjustable flow rate

133. A juice purification system as described in claim 119 wherein said interface with
5 said juice has a variably adjustable surface area.

134. A juice purification system as described in claim 133 further comprising a gas distribution element to distribute said at least one gas through substantially the entire volume of said juice.

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135. A juice purification system as described in claim 134 wherein said gas distribution element comprises an impeller of a pump.

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136. A juice purification system as described in claim 134 wherein said gas distribution element comprises a reduction in conduit size through which said stream of juice flows.

137. A juice purification system as described in claim 119 further comprising a source of reduced pressure on said stream of juice.

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138. A juice purification system as described in claim 137 wherein said source of reduced pressure comprises atmospheric pressure fluidically coupled to said interface with said juice.

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139. A juice purification system as described in claim 137 wherein said source of reduced pressure comprises a vacuum pump fluidically coupled to said interface with said juice.

140. A method of purifying juice obtained from plant material, comprising the steps of:

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a. obtaining plant material;
b. removing juice from said plant material to obtain a process liquid, wherein said process liquid contains sucrose, non-sucrose substances, and water, and wherein a portion of said non-sucrose substances comprise dissolved material;

- c. heating said process liquid to a temperature between about 55°C to about 80°C;
- c. introducing a mixture of gases into said process liquid;
- d. establishing a process liquid-gas interface area between said process liquid and said mixture of gases; and
- e. reducing concentration of said dissolved material within said process liquid to less than the initial concentration of said dissolved material in said process liquid.

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- 10 141. A method of purifying juice obtained from plant material as described in claim 140, further comprising the steps of:
 - a. spreading said process liquid over the surface area of a container; and
 - b. venting the interior of said container to atmosphere.
 - 15 142. A method of purifying juice obtained from plant material as described in claim 141, wherein said step of spreading said process liquid over the surface area of a container comprises applying centrifugal forces to said process liquid.
 - 20 143. A method of purifying juice obtained from plant material as described in claim 141, wherein said step of applying centrifugal forces to said process liquid comprises centrifugal forces greater than three times gravity.
 - 144. A method of purifying juice obtained from plant material as described in claim 25 143, further comprising the steps of:
 - a. dispersing said process liquid to increase said process liquid-gas interface; and
 - b. flowing a mixture of gases through dispersed process liquid.
 - 145. A method of purifying juice obtained from plant material as described in claim 30 144, further comprising the steps of:
 - a. dispersing said process liquid to increase said process liquid-gas interface; and
 - b. reducing partial pressure of gases at said liquid-gas interface.

146. A method of purifying juice obtained from plant material as described in claim 145, wherein said step of reducing partial pressure of gases at said liquid-gas interface comprises generating partial pressures of gases below atmospheric pressure.

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